



Assessment of the quality and detection of adulteration of raw milk of local markets in Bangladesh

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General Note



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ABSTRACT

This experiment was conducted to explore the quality of milk collected from local markets on the basis of quality evaluation and adulteration test. Dapunia Bazar, Deokhola Bazar, Fulbaria sadar, Jhulbari Bazar and Katalsen Bazar of Fulbaria upazila under

Mymensingh district of Bangladesh were selected for case study. Physical parameters used to observe the quality of milk samples such as color, flavor, taste, texture, acidity test, clot-on-boiling test, and starch test. Chemical parameters such as water, total-solids, Solids-not-fat, protein, fat, ash and specific gravity were used to observe the quality of milk samples. From the chemical parameters, it was found that the milk samples showed mean water content 883.30, 859.99, 870.11, 879.08 and 863.10g/kg, TS 115.70, 140.01, 129.89, 120.78 and 136.90g/kg, SNF 79.06, 98.54, 85.63, 76.53 and 99.40g/kg, protein 32.73, 27.53, 29.33, 32.73 and 31.13g/kg, fat 33.33, 44.80, 44.27, 37.60 and 37.33g/kg, ash 6.26, 7.67, 6.76, 8.36 and 7.13g/kg and acidity 0.150, 0.165, 0.174, 0.167 and 0.152 respectively for Dapunia Bazar, Deokhola Bazar, Fulbaria sadar, Jhulbari Bazar and Katalen Bazar. The tested samples of local markets showed significantly ($p < 0.05$) between acidity and fat content of collected samples. There were no significant differences ($p > 0.05$) among the water, total-solids, solid-not-fat, protein, ash of milk samples. It was also revealed that milk samples collected from Deokhola bazar were superior to that of other samples used. This study suggests that strong monitoring is necessary to improve quality and adulteration free milk.

Keywords: Raw milk, Adulteration, quality evaluation, heavy metal, Bangladesh

1. INTRODUCTION

Milk is an essential part of daily food for the mothers as well as growing child (Gondim et al., 2017). Milk and milk products are considered as the most important part of well-balanced food for human diet (Shaker et al., 2015). There is no single food which can be an alternative and substitute the milk (Sarker, 2016b; Prodhan et al., 2017; Sarker et al., 2019). Milk is hereby legally defined to be the lacteal discharge, basically free from colostrum, gained by the complete milking of healthy cows, five days after and fifteen days before parturition, which contains not less than 8.5 percent milk solids not fat and not less than 3.5 per cent milk fat (Hasan et al., 2017; Sarker et al., 2017; Khan et al., 2018; Sarker et al., 2019).

The composition of normal cow's milk varies to a great extent. The main ingredients of milk are water, protein, fat, carbohydrate and ash (Azad & Ahmed, 2016). Besides these components, milk also contains a considerable amount of fat-soluble vitamins (A, D, E & K) and water-soluble vitamins (B complex and C) (Haider et al., 2015; Islam et al., 2018; Sarker et al., 2019). The ingredients may vary due to breed, feed type, lactation period, time, age of the cow. Milk fat often called "Butter fat" is commonly the most valuable constituent of milk. Milk fat has importance in nutrition for the existence of valuable fatty acids and huge short-chain volatile fatty acids (Islam et al., 2018). Milk fat is easily digestible and serves as the concentrated source of energy and each gram of fat furnishes 9 calories energy that is 2.25 times higher than protein as well as carbohydrate (Meier & Aquino, 2015). Milk is a transporter of fat-soluble vitamins which can help in lactose assimilation. The protein of milk is not a single compound but includes two major protein namely: casein (80 percent of the total protein) and lactalbumin (18 percent) and lactoglobulin (2 percent) (Perera et al., 2019). The essential amino acids like tryptophan and lysine are present in large quantity in milk which is deficient in vegetable protein. Calcium and phosphorus, which are important in the formation of bone and teeth and all most of the essential minerals needed for the body, are present in milk. Milk is also a rich source of all known vitamins, which are essential for human health and nutrition. Moreover, some are present in large quantity than a human requirement.

The total milk production in Bangladesh was 2.82 million tons in 2010. Comparing with this expending demand milk powder is being imported and some of which reported being harmful to health due to containing a higher level of radioactive material. For fulfilling consumer's demand, producer needs to produce quality milk. Quality milk is free from harmful bacteria as well as toxic materials, sediment and extraneous materials, best flavor, standard composition, adequate in storing quality and low bacteria.

In Bangladesh, milk is produced mostly in non-organized way and usually it is being supplied to consume from the urban and rural areas by Goals (Sarker et al., 2007; Sarker et al., 2015; Sarker, 2016a; Sarker, 2016c; Sarker et al., 2019). Although there is low number of milk processing industry and dairy farm but this perishable product could not get proper attention for healthy distribution to the consumers (Sarker & Jie, 2017; Sarker, 2017; Sarker et al., 2018; Nasrin et al., 2019). So, this study was done to investigate the physical parameters as well as microbiological quality of raw milk (total viable count, Coliform count, Staphylococcal count) from different local markets of Mymensingh District of Bangladesh.

From the existing literature, it is very much clear that a lot of factors are responsible for changing the quality of milk. Platform tests are very much needed to monitor the quality of raw milk. Very limited numbers of research works have been done in the past in this connection. Hence, this research work was designed to fulfill the knowledge of gap in this line. Therefore, this experiment was conducted to know the qualities of milk available in local markets on the basis of quality evaluation and adulteration test.

2. MATERIALS AND METHODS

Site and period of experiment

The present experiment was conducted at Dairy Technology Laboratory of the Department of Dairy Science, Bangladesh Agricultural University, Mymensingh during the period from 9th April to 3th June 2017.

Collection of samples

Raw milk samples were collected from 3 different markets of Mymensingh town. For one trial a total of 8 milk samples were collected from each market, out of which 4 samples were from morning milk and another 4 from evening milk. Thus a total of 24 raw milk samples were received from 3 different markets of Mymensingh town and were transferred to the Dairy Technology Laboratory by keeping them in the bottles. These samples were preserved in the refrigerator prior to the experiment.

Analysis of the samples

The following physical, chemical and microbiology tests were carried out with each raw milk samples.

Physical tests

The major physical tests were organoleptic (colour, flavour, texture), specific gravity (Sp. gr.), chemical tests, determination of acidity content, determination of fat content, determination of solids-not-fat (snf) content, determination of total solids (ts) content, determination of ash content, determination of protein content, determination of lactose content, microbiological examinations, determination of total viable count, and determination of coliforms count.

Analytical procedure

The physical parameters like organoleptic test was performed visually and nasally to observed the color, flavor and textures by a panel of judges who evaluated the samples. The specific gravity test was performed using Quevenne lactometer, Lactometer cylinder and floating dairy. Fat test was performed by Babcock fat test methods as described by Aggarwala and Sharma (1961). Acidity test was done by titrating milk with N/10 NaOH solution. Protein test was done by formal titration method which is elaborately described in the appendix section. SNF and TS were calculated by the mathematical formula which is also given in the appendix section. The experimental procedures followed for the determination of the number of total viable bacteria in a sample and the detection and enumeration of coliforms bacteria were as per recommendation American Public Health Association (APHA).

Statistical analysis

The experiment was conducted in Completely Randomized Design (CRD) with two factors; Factor I was farm and Factor 2 was time. The data was statistically analyzed the help of MSTAT statistical program to find out the statistical differences among the different parameters studied from five different sources of milk.

3. RESULTS AND DISCUSSION

Physical parameters

The results for physical parameters of milk samples obtained from the five places are presented in the (Table 1). There were remarkable differences among the physical parameters like color, flavor, taste, texture and specific gravity of milk samples obtained from the five different sources.

Color

The color of all the milk samples from five different local markets (Bhangnamari, Sutiakhali, Vabokhali, Sombhuganj, mymensing sadar) were golden yellowish, yellowish white and whitish in color. While the milk samples collected from the Dapunia Bazar were 26.67% Golden yellowish, 46.67% Yellowish White, 26.67% Whitish in color; Deokhola Bazar were 60% Golden yellowish, 26.67% Yellowish White, 13.33% Whitish in colour; Fulbaria sadar were 60% Golden yellowish, 20% Yellowish White, 20% Whitish in colour; Jhulbari Bazar were 33.33% Golden yellowish, 33.33% Yellowish White, 33.33% Whitish in colour and Katalen Bazar were 46.67% Golden yellowish, 46.67% Yellowish White, 26.67% Whitish in colour (Table 1).

This difference in color may be due to the differences in nature of feed the cows consumed, the breed, the fat and solids contents of the milk. The colour of milk depends upon the breed, the amount of fat and solids present and most of all cases it

depends upon the nature of feed the cow consumed. Similar type of results were also reported that due to Carotene (to some extent xanthophylls), milk imparts a yellowish in colour (Institute of Food Technology).

Table 1 Some Physical parameters of milk samples collected from 5 local markets.

Physical parameters	Dapunia Bazar	Deokhola Bazar	Fulbaria sadar	Jhulbari Bazar	Katalsen Bazar
Colour	Golden yellowish=26.67% Yellowish White= 46.67% Whitish = 26.67%	Golden yellowish=60% Yellowish White= 26.67% Whitish = 13.33%	Golden yellowish=60% Yellowish White= 20% Whitish = 20%	Golden yellowish=33.33% Yellowish White= 33.33% Whitish = 33.33%	G. Yellowish=46.67% Yellowish White= 26.67% Whitish = 26.67%
Flavour	Normal flavour = 100% (Pleasant aromatic)	Normal flavour = 80% (Pleasant aromatic) Acid Flavour = 20%	Normal flavour = 100% (Pleasant aromatic)	Normal flavour = 66.67% (Pleasant aromatic) Acid Flavour = 33.33%	Normal flavour =53.33% (Pleasant aromatic) Acid flavor= 46.67%
Taste	Slightly sweet= 100%	Slightly sweet= 100%	Slightly sweet= 100%	Slightly sweet= 100%	Slightly sweet= 100%
Texture	Free flowing liquid= 100%	Free flowing liquid= 100%	Free flowing liquid= 100%	Free flowing liquid= 100%	Free flowing liquid= 100%
Specific gravity	1.026±.000 (1.018-1.035)	1.027±.000 (1.018-1.031)	1.027±.000 (1.021-1.032)	1.030±.000 (1.027-1.032)	1.024±.000 (1.016-1.031)

Flavour

The average flavours of milk are presented in Table 1. It was found that of the milk samples collected from Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katalsen Bazar. From these bazar milk sample collected from Dapunia Bazar and Fulbaria sadar were normal flavour (pleasant aromatic flavour). This might be due to the fact that the farmers take hygienic measures during milking and not to allow the cows to eat some sorts of flavored feed prior to or during milking their cows. This results agrees with the work of Islam et al. (M. A. Islam, Sarker, Prabakusuma, Russel, & Islam, 2018) who showed that the milk flavor was normal (pleasant and aromatic) collected from Bangladesh Agricultural University dairy farm, Mymensingh.

Taste

The taste of all milk samples collected from five different place of Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katalsen Bazar were slightly sweet in taste in (Table 1). Normal taste of milk collected from Bangladesh Agricultural University Dairy Farm that milking has been done hygienically at Bangladesh Agricultural University Dairy Farm. The odd taste of the milk may be due to the unhygienic condition where the milking has done, probably holding the milk for a long time, prior to sale, which provide opportunity to develop some micro-organisms which cause some odd taste like sour, bitter etc.

Texture

The texture of milk samples was evaluated before starting the experiment. All the milk samples (100%) collected from different local market of Fulbaria Upazila showed normal texture (free flowing liquid). These results indicates that quality of milk obtained from different local market of Fulbaria Upazila were superior.

Specific Gravity

The mean and standard deviations of specific gravity of milk collected from Dapunia Bazar, DeokholaBazar, Fulbaria sadar, Jhulbari Bazar and Katalsen Bazar were 1.026±.000, 1.027±.000, 1.027±.000, 1.030±.000 and 1.024±.000 respectively. The ranges at specific gravity were 1.018-1.035, 1.018-1.031, 1.021-1.032, 1.027-1.032 and 1.016-1.031 respectively.

Statistical analysis showed that specific gravity of milk collected from different sources differ significantly ($p < 0.05$). Numerically the specific gravity of Deokhola Bazar and Fulbaria sadar were the same. The milk of Jhulbari Bazar were superior to the milk of Dapunia Bazar, Deokhola Bazar, Fulbaria sadar and Katsalen Bazar. The specific gravity of milk of Katsalen Bazar was inferior to others and the specific gravity of Dapunia Bazar was superior to the milk of Katsalen Bazar and inferior to the sample of Deokhola Bazar and Fulbaria sadar (shown in Table 2).

Table 2 Chemical parameter of milk samples, collected from different market

Parameter	Milk samples collected from the sources of ($\bar{X} \pm \text{SD}$, Range)					Level of Significance
	Bhangnamari (A)	Sutiakhali (B)	Vabokhali Bazar (C)	Sombhuganj Bazar (D)	Mymensingh Sadar (E)	
Moisture (g/kg)	879.100 \pm 7.84	874.067 \pm 8.64	881.667 \pm 4.04	879.00 \pm 4.00	873.667 \pm 12.10	NS
TS (g/kg)	121.567 \pm 7.28	126.00 \pm 8.54	118.333 \pm 4.04	121.00 \pm 4.04	126.333 \pm 12.10	NS
SNF (g/kg)	72.930 \pm 8.78	88.333 \pm 11.74	79.333 \pm 6.81	88.333 \pm 7.23	95.667 \pm 11.72	NS
Protein (g/kg)	33.423 \pm 1.83	32.957 \pm 2.88	34.717 \pm 2.63	34.867 \pm 2.85	33.927 \pm 3.01	NS
Fat (g/kg)	48.66 \pm 3.51 ^a	37.66 \pm 3.20 ^b	39.00 \pm 3.61 ^{ab}	32.66 \pm 4.04 ^b	30.66 \pm 4.51 ^b	**
Ash (g/kg)	6.300 \pm 0.60	6.867 \pm 0.60	6.733 \pm 0.50	7.100 \pm 0.40	7.600 \pm 0.36	NS
Acidity	0.180 \pm 0.03	0.187 \pm 0.04	0.150 \pm 0.03	0.167 \pm 0.01	0.183 \pm 0.02	NS

Note: \bar{X} = Mean, SD = Standard deviation, ** = Significant at 1% level, NS = Non-significant

The result of specific gravity of milk of Jhulbari Bazar (1.030 \pm . 000) was in agreement with Bari (2001), who found that the average specific gravity of Cow's milk from BAU Dairy Farm was 1.031. Similarly Lateef *et al.* (2009) observed that the specific gravity of cow's milk was 1.02 \pm 0.010.

The result of specific gravity indicates that milk of Jhulbari Bazar was not adulterated. But the range of specific gravity of Jhulbari Bazar was 1.027-1.032. On the other hand, the ranges of specific gravity of milk of Dapunia Bazar, Deokhola Bazar, Fulbaria sadar and Katsalen Bazar milk were 1.018-1.035, 1.018-1.031, 1.021-1.032 and 1.016-1.031, these values could not satisfy the normal range of 1.028-1.034 (BSTI-2000) and the mean values 1.026, 1.027, 1.027 and 1.024 respectively were lower than standard 1.032. Comparing test value of specific gravity with BSTI range, it was found that, each out of 60 samples; 15 samples collected from Dapunia Bazar, 15 samples collected from Deokhola Bazar, 15 samples collected from Fulbaria sadar and 15 sample collected from Katsalen Bazar.

Chemical Parameters

Water Content

The mean and standard deviation of water content of milk samples collected from Dapunia Bazar, Deokhola Bazar, Fulbaria sadar, Jhulbari Bazar and Katsalen Bazar were 883.30 \pm 10.00, 859.99 \pm 19.0, 870.11 \pm 9.40, 879.08 \pm 0.90 and 863.10 \pm 16.1 g/kg respectively. The ranges of water content of milk sample were in between of 869.80-889.70, 824.80-910.60, 81 5.80-922.80, 859.80-906.60 and 830.85-907.70 ml/L respectively.

Water content of milk samples of different source was statistically non-significant. In this experiment statistically highest value of water was obtained from the samples collected from Dapunia Bazar (883.30g/kg) and lowest value obtained from the samples collected from Deokhola Bazar (859.99g/kg). The milk of Fulbaria sadar, Jhulbari Bazar were treated as normal and its quality were good and it were qualitatively normal. Water content of milk sample of Fulbaria sadar 870.11g/kg and Jhulbari Bazar 879.08g/kg were statistically similar but numerically samples of Fulbaria sadar contain more water than the sample of Katsalen Bazar. Water content of milk of Dapunia Bazar was higher than that of samples of Deokhola Bazar, Fulbaria sadar and Jhulbari Bazar. Water content in the samples of local market of Dapunia Bazar was indicates a adulteration with water. The results of highest water content of local markets were in agreement with Asaduzzaman (2000), who found statistically higher water content in milk (895.77 g/kg) collected from local markets of Mymensingh Town.

Total Solids (TS)

There were remarkable differences between the total solids contents of milk of different local markets of Fulbaria upazilla. The mean and standard deviation of total solids content of milk collected from Dapunia Bazar, Deokhola Bazar, Fulbaria sadar, Jhulbari Bazar and Katsalen Bazar were 115.70 \pm 10.0, 140.01 \pm 19.0, 129.89 \pm 9.4, 120.78 \pm 0.7 and 136.90 \pm 16.1 g/kg respectively. The ranges of total

solids of those samples were 80.66-220.81, 63.03-139.39, 98.22-155.01, 93.45-148.39 and 79.93-228.21 g/kg respectively. The total solids of milk samples of different sources differ significantly ($p < 0.05$). In this study statistically highest value of total solids content was obtained from the milk samples collected from Deokhola Bazar (140.01g/kg). The total solids content of milk collected from Fulbaria sadar (129.89g/kg) was statistically similar to total solids content of milk collected from Jhulbari Bazar (120.78g/kg). But numerically the milk samples of Fulbaria sadar were better than the milk samples of Dapunia Bazar and poorer than that of the milk samples of Deokhola Bazar. The total solids contents of milk samples of Jhulbari Bazar (120.78g/kg) was higher than the TS content of milk samples of Dapunia Bazar (115.70g/kg) and lower than the total solids content of milk samples of Deokhola Bazar (140.01g/kg), Deokhola Bazar (129.89g/kg) and Katalen Bazar (136.90g/kg). The lowest value was obtained from the milk samples of Dapunia Bazar. Numerically TS content of all sources of milk could be remarked in the order of Deokhola Bazar > Katalen Bazar > Deokhola Bazar > Fulbariasadar > Dapunia Bazar.

The samples collected from Deokhola Bazar and Katalen Bazar was not adulterated, because all the samples were known but others samples were unknown. The lower values of TS content of milk collected from Dapunia Bazar and Jhulbari Bazar might be due to adulteration with water. The results are in agreement with a number of workers. The value was reported by Islam (2006) who studied the milk quality of local cows in BAU, dairy farm and found that the total-solids content of cow's milk was 142.50g/kg.

Solids-not-fat (SNF)

The mean and standard deviation of SNF percentage of milk samples collected from Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katalen Bazar were 79.06 ± 13.5 , 98.54 ± 21.5 , 85.63 ± 6.95 , 76.53 ± 2.8 and $99.40 \pm 13.6\%$ respectively. Statistical analysis showed that the differences between the solids-not-fat percentage of above milk samples was found not significant ($p > 0.05$). The results of the chemical analysis of SNF content of the collected samples are in agreement with a number of authors. The average SNF percentage of milk collected from milk samples were 87.83g/kg which agreed with Islam et al. (2018) who reported that the average SNF percentage of milk of local cows was 87.0g/kg. Hasan et al. (2017) also showed that higher SNF percentage in milk collected from Bangladesh Agricultural University Dairy Farm was 98.65g/kg.

Protein

The average values and standard deviation of protein content of milk samples collected from Dapunia Bazar, Deokhola Bazar, Fulbaria sadar, Jhulbari Bazar and Katalen Bazar were 32.73 ± 2.4 , 27.53 ± 1.2 , 29.33 ± 1.6 , 32.73 ± 4.2 and 31.13 ± 3.0 g/kg respectively. Statistical analysis showed that the differences between the protein percentage of milk obtained from the above five places were non-significant ($p > 0.05$). From the experimental result, it may be concluded that the protein content of milk sample collected from Dapunia Bazar and Jhulbari Bazar were higher than other sources of milk sample. The results agree with the work of Hasan et al. (2017), they reported that the average values of protein content were 36.65 g/kg from the dairy farm, BAU, Mumensingh.

Fat content

The mean fat content and its standard deviation in the milk of Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katalen Bazar were 33.33 ± 2.1 , 44.80 ± 3.20 , 44.27 ± 3.4 , 37.60 ± 8.7 and 37.33 ± 1.5 g/kg respectively. The ranges were 18-55, 31-65, 16-61, 22-65 and 27-60 g/kg respectively.

Statistical analysis showed that the average fat contents of milk samples collected from different sources differ significantly. In this experiment the highest value of milk-fat was obtained from the milk of Deokhola Bazar. The fat content of milk collected from Jhulbari Bazar was statistically similar to the milk-fat of Katalen Bazar but statistically lower than the milk-fat of Fulbaria sadar and Jhulbari Bazar. The fat content of milk of Jhulbari Bazar was statistically superior to milk-fat of Dapunia Bazar but inferior to the milk-fat of Deokhola Bazar, Fulbaria sadar and statistically similar with the fat content of milk of Katalen Bazar.

According to the proposed standard of BSTI-2002 the average fat content of milk is 35g/kg. The average fat content of milk samples collected from Dapunia Bazar, Jhulbari Bazar and Katalen Bazar were found to be satisfactory compared to BSTI standard but the average fat content of milk samples collected from Deokhola Bazar, Fulbaria sadar does not satisfy the BSTI standard. The low-fat content milk collected from local markets may be due to adulteration with water, which reduces the fat content of milk samples. This might also be due to the skimming or withdrawing of the fat of market milk samples before the milk was presented in the markets for sale. Comparing the test value of fat with BSTI range, it was found that each out of 75 samples; 15 samples collected from Dapunia Bazar, 15 samples collected from Deokhola Bazar, 15 samples collected from Fulbariasadar, 15 samples collected from Jhulbari Bazar, and 15 samples collected from Katalen Bazar were collected.

The fat content of the milk sample of Dapunia Bazar was lower than the sample of Fulbaria sadar, Jhulbari Bazar. The results are in agreement with the work of Hasan et al. (Hasan et al., 2017) who found that milk sample collected from BAU dairy farm, had higher fat content than that of market samples was 44.35g/kg.

Ash

The average values and standard deviation of ash content of milk samples collected from Dapunia Bazar, Deokhola Bazar, Fulbaria sadar, Jhulbari Bazar and Katsalen Bazar were 6.26 ± 0.9 , 7.67 ± 1.7 , 6.76 ± 0.8 , 8.36 ± 1.1 and 7.13 ± 1.7 g/kg respectively. Statistical analysis showed that the differences between the ash percentage of milk obtained from the above five places were non-significant ($p > 0.05$). From the experimental result, it may be concluded that the ash content of milk sample collected from Jhulbari Bazar was higher than other sources of milk sample.

Acidity

Results of Acidity of raw milk sample collected from Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katsalen Bazar were 0.150 ± 0.00 , 0.165 ± 0.03 , 0.174 ± 0.02 , 0.167 ± 0.02 and 0.152 ± 0.02 respectively. Statistically, it was found that there were no significant differences ($P > 0.05$) within the mean acidity of milk sample collected from these places. Generally, the acidity of normal milk sample varies within the range of 0.10 to 0.18% within an average of 0.16%. In this experiment, the acidity value of different milk sample was within the normal range. Higher percentage acidity may be due to a microbial activity or enzymatic reaction. Besides, acidity of milk collected from different sources depends sometimes on the time required from milking up to receiving milk in that bazaar. The higher content of SNF in milk may show a slightly higher percentage of acidity and lower contents show lower acidity. The result of the acidity of milk collected from different sources was in agreement with Bari (2001), who found that acidity percentage of Mymensingh town was $0.141 \pm 0.03\%$ and also the average percentage of cow's milk in Bangladesh Agricultural University Dairy Farm was 0.144 ± 0.01 . Hasan et al. (2017) also found that the average of acidity milk samples from Bangladesh Agricultural University Dairy Farm; different Hall milk suppliers and vendors were 0.15%, 0.16%, and 0.15% respectively.

Test for Adulteration

Clot-on-boiling test (COB)

The results for COB test of milk sample collected from Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katsalen Bazar. All the samples are collected from these places showed negative results of COB test. The results of the acidity test were confirmed by COB test. Hasan et al. (2017) found that the COB tests were negative and indicated that there was no developed acidity. Islam et al. (2018) showed that all the samples are collected from BAU Dairy Farm Showed negative results of COB test.

Starch Test

The results for starch test of milk sample collected from Dapunia Bazar, Deokhola Bazar, Fulbariasadar, Jhulbari Bazar and Katsalen Bazar. All the samples are collected from these places showed negative results of the starch test. Addition of starch also increases the SNF content of milk. Apart from the starch, wheat flour, arrowroot, rice flour are also added.

4. CONCLUSION

This study was conducted to test the physical and chemical parameters of collected milk samples of different sources and known adulterants mixed milk samples. For this purpose, two experiments were conducted in this study. In the first experiment, milk samples were collected from five different places named Dapunia Bazar, Deokhola Bazar, Fulbaria Town, Jhulbari Bazar and Katsalen Bazar. A total 75 milk samples were collected from five markets taking 15 samples from Dapunia Bazar, 15 samples from Deokhola Bazar, 15 samples from Fulbaria Town, 15 samples from Jhulbari Bazar, and 15 samples from Katsalen Bazar were collected. After collected milk sample from a sample from the market, they were taken to the laboratory for analysis. Parameters used to monitor the adulteration status of milk were specific gravity, fat test, total solids test, water content, acidity test, and protein test. It is observed that the mean and standard deviation of Specific gravity, Fat, TS, Water, protein, and ash from milk within five markets were 1.026 ± 0.000 , 1.027 ± 0.000 , 1.027 ± 0.000 , 1.030 ± 0.000 , 1.024 ± 0.000 , 33.33 ± 2.1 , 44.80 ± 3.20 , 44.27 ± 3.4 , $37.60 \pm 8.$, 37.33 ± 1.5 , 115.70 ± 10.0 , 140.01 ± 19.0 , 129.89 ± 9.4 , 120.78 ± 0.7 , 136.90 ± 16.1 , 883.30 ± 10.00 , 859.99 ± 19.0 , 870.11 ± 9.40 , 879.08 ± 0.90 , 863.10 ± 16.1 , 32.73 ± 2.4 , 27.53 ± 1.2 , 29.33 ± 1.6 , 32.73 ± 4.2 , 31.13 ± 3.0 , 6.26 ± 0.9 , 7.67 ± 1.7 , 6.76 ± 0.8 , 8.36 ± 1.1 , 7.13 ± 1.7 respectively. From the above data, it was observed that all the parameters were statistically highly significant within the partner. The ranged of physical and chemicals parameters of specific gravity, fat, TS, water, protein and ash from milk within five markets were 1.018-1.035, 1.018-1.031, 1.021-1.032, 1.027-1.032 and 1.016-1.031, 18-55, 31-65, 16-61, 22-65 and 27-60, 80.66-220.81, 63.03-139.39, 98.22-155.01, 93.45-

148.39 and 79.93-228.21, 869.80-889.70, 824.80-910.60, 81 5.80-922.80, 859.80-906.60 and 830.85-907.70, 21-46, 19.1-40.0, 23.2-39.0, 20-61, 20-45, 5.2-6.8, 1.9-8.8, 6.5-9.9, 6.0-9.4, 6.1-8.0 respectively.

Malnutrition is a serious problem of Bangladesh. About 56% of total population of our country suffers from malnutrition and this rate is highest in the world. We are yet to ensure two squares meal per day for the distressed and hungry millions of our country. Per capita availability of milk is 37g/day against the requirement of 240g/capita/day. Milk is said to be an ideal food for the children as well as for the adult. Milk is required to prepare different types of food. But consumers are exploited by dishonest milkman or vendors. Dishonest milkman adulterates milk by adding water, skim milk, sugar, flour, etc. Adulteration is a common evil practice in our country. We frequently consume adulterated oil, honey, and milk. Adulterated of milk is a simpler practice compared to other adulteration. Milk sample collected from local market showed different levels of adulteration. People of our country have minimum knowledge about the determination of milk. Low enforcing agencies, govt. and non-government organizations and other concerned quarters do not bear the responsibilities of monitoring the quality of milk in our country. To build up a healthy nation, supply of pure food including pure milk is essential. Punitive measures should be taken against dishonest milk man to ensure supply of pure milk. Government of Bangladesh should take necessary steps to controls adulteration of milk with a view to building up a disease-free, healthy and talent nation.

Authors' contributions

All authors contributed equally from research design to manuscript preparation. All authors checked the final manuscript and approved for publication.

Disclosures about potential conflict of interests

All the authors declare that there is no potential conflict of interest among the authors.

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